

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A system for direct mesh manipulation of a mesh model for the computer-assisted design of a product comprising:

a computer system, wherein said computer system includes a memory, a processor, a user input device and a display device;

a computer generated geometric model stored in said memory of said computer system, wherein said model is in a computer-aided design (CAD) format; and

a user using the computer system to convert the CAD model into a mesh model, and iteratively evaluate the mesh model ~~using~~ until a predetermined response is generated by performing a computer-aided engineering (CAE) analysis of the mesh model, modify ~~modifying~~ a ~~predetermined~~ design ~~criteria~~ parameter based on the CAE analysis, and ~~update~~ updating the mesh model to include the modified design parameter by direct mesh manipulation of a surface of the mesh model using Dirichlet parameter distribution to determine deformation of ~~[[a]]~~ the surface of the mesh model, so that the ~~updated~~ evaluation of the mesh model is ~~available for further study~~ used in the design of the product.

2. (Original) A system as set forth in claim 1 wherein the computer system includes a knowledge-based engineering library and the geometric model is stored in the knowledge-based engineering library.

3. (Original) A system as set forth in claim 1 wherein the computer system updates the mesh model using direct mesh manipulation, wherein a surface is modeled as a linear elastic sheet to determine deformation of the surface of the mesh model.

4. (Original) A system as set forth in claim 1 wherein the computer system updates the mesh model using direct mesh manipulation, by modeling a surface as a lattice structure to determine the deformation of the surface.

5. (Currently Amended) A method of direct mesh manipulation of a mesh model for the computer-assisted design of a product, said method comprising the steps of:

selecting a geometric model, wherein the model is in a computer-aided design (CAD) format;

converting the CAD model into a mesh model;

iteratively evaluating the mesh model ~~using a computer-aided engineering (CAE) analysis~~; until a predetermined response is generated by:

performing a computer-aided engineering (CAE) analysis of the mesh model;

determining whether to vary a design ~~riterion~~ parameter based on the CAE analysis;

modifying the predetermined design ~~riterion~~ parameter, if determined to vary
 [[a]] the design ~~riterion~~ parameter;

updating the mesh model to include the modified design ~~riterion~~ parameter using direct mesh manipulation (DMM) of the mesh model, wherein a surface of the mesh model affected by the modified design ~~riterion~~ parameter is described using a Dirichlet parameter distribution to determine a displacement of the surface; and

modifying the ~~feature~~ surface of the mesh model by the amount of the displacement; and

using the ~~updated~~ evaluation of the mesh model in the design of the product.

6. (Currently Amended) A method as set forth in claim [[4]] 5 wherein said step of updating a mesh model includes the steps of:

bounding a feature on the surface of the model with a closed curve;
defining an influence center for the feature;
modifying a mesh for the feature to include a node at the influence center; and
applying the Dirichlet parametric distribution to the mesh of the feature to determine displacement of each node within the feature.

7. (Original) A method as set forth in claim 6 including the step of using finite element analysis to determine the displacement from the Dirichlet parametric distribution.

8. (Original) A method as set forth in claim 6 wherein the maximum displacement of the surface is at the influence center.

9. (Currently Amended) A method of direct mesh manipulation of a mesh model for the computer-assisted design of a product, said method comprising the steps of:

selecting a geometric model, wherein the model is in a computer-aided design (CAD) format;

converting the CAD model into a mesh model;

iteratively evaluating the mesh model ~~using a computer-aided engineering (CAE) analysis;~~ until a predetermined response is generated by:

performing a computer-aided engineering (CAE) analysis of the mesh model;

determining whether to vary a predetermined design ~~riterion~~ parameter based on the CAE analysis;

modifying the predetermined design ~~riterion~~ parameter, if determined to vary the design ~~riterion~~ parameter;

updating the mesh model to include the modified design ~~riterion~~ parameter using direct surface manipulation (DMM) of the mesh model, wherein a surface of the mesh model is described as an elastic sheet and linear elastic finite element analysis is applied to determine a displacement of the surface; and

modifying the surface of the mesh model by the amount of the displacement; and using the ~~updated~~ evaluation of the mesh model in the design of the product.

10. (Original) A method as set forth in claim 9 wherein said step of updating the mesh model includes the steps of:

bounding a feature on the surface of the model with a closed curve;

defining an influence center for the feature;

modifying a mesh for the feature to include a node at the influence center;

describing the deformed feature as a linear elastic sheet that is stretched; and

determining the displacement of each node in the mesh of the feature using linear elastic finite element analysis.

11. (Original) A method as set forth in claim 10 wherein the maximum displacement of the surface is at the influence center.

12. (Currently Amended) A method of direct mesh manipulation of a mesh model for the computer-assisted design of a product, said method comprising the steps of:

selecting a geometric model, wherein the model is in a computer-aided design (CAD) format;

converting the CAD model into a mesh model;

iteratively evaluating the mesh model ~~using a computer aided engineering (CAE) analysis~~; until a predetermined response is generated by:

performing a computer-aided engineering (CAE) analysis of the mesh model;

determining whether to vary a predetermined design ~~criterion~~ parameter based on the CAE analysis;

modifying the predetermined design ~~criterion~~ parameter, if determined to vary the design ~~criterion~~ parameter;

updating the mesh model to include the modified design criterion using direct surface manipulation (DSM) of the mesh model, wherein a surface of the mesh model is embedded within a lattice structure having a volume, a point within the volume is modified, and finite element analysis is applied to determine a displacement of each node within the lattice[[,]] ; and

modifying the surface of the mesh model by the amount of the displacement; and using the ~~updated~~ evaluation of the mesh model in the design of the product.

13. (Original) A method as set forth in claim 12 wherein said step of updating the mesh model includes the steps of:

bounding a region of the mesh containing the surface with a lattice;

determining a position of a node for the mesh with respect to the lattice boundaries;
deforming a lattice point a predetermined displacement;
using linear elastic finite element analysis to determine displacement of the lattice point;
and
determining displacement of mesh nodes within the lattice to maintain their position with respect to the lattice boundary using linear elastic finite element analysis.

14. (Original) A method as set forth in claim 13 wherein said lattice point is a corner point of the lattice structure.

15. (Original) A method as set forth in claim 13 wherein the lattice point is a point within the interior of the lattice.

16. (New) A method as set forth in claim 6 wherein the feature is a self-contained geometric entity on the surface of the mesh model.

17. (New) A method as set forth in claim 10 wherein the feature is a self-contained geometric entity on the surface of the mesh model.

18. (New) A method as set forth in claim 13 wherein the feature is a self-contained geometric entity on the surface of the mesh model.